Name: ______________________________ Date: ______________

Polynomial Operations SOLUTIONS (version 35)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = 8x^5 + x^4 - 3x^2 + 9x - 5$$

$$q(x) = 9x^5 - 5x^4 - x^3 - 3x^2 - 10$$

Express the difference $p(x) - q(x)$ in standard form.

Get "unsimplified" forms. Then find $p(x) - q(x)$ with addition/subtraction.

$$\begin{aligned}
p(x) &= (8)x^5 + (1)x^4 + (0)x^3 + (-3)x^2 + (9)x^1 + (-5)x^0 \\
q(x) &= (9)x^5 + (-5)x^4 + (-1)x^3 + (-3)x^2 + (0)x^1 + (-10)x^0 \\
p(x) - q(x) &= (-1)x^5 + (6)x^4 + (1)x^3 + (0)x^2 + (9)x^1 + (5)x^0 \\
p(x) - q(x) &= -x^5 + 6x^4 + x^3 + 9x + 5
\end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = -6x^2 - 5x + 3$$

$$b(x) = -9x + 6$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$-6x^2$	$-5x$	3
$-9x$	$54x^3$	$45x^2$	$-27x$
6	$-36x^2$	$-30x$	18

$$a(x) \cdot b(x) = 54x^3 + 45x^2 - 36x^2 - 27x - 30x + 18$$

Combine like terms.

$$a(x) \cdot b(x) = 54x^3 + 9x^2 - 57x + 18$$

3. Express $(x+1)^6$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^6 + 6x^5 + 15x^4 + 20x^3 + 15x^2 + 6x + 1$$

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4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= -3x^3 - 24x^2 + x + 18 \\ g(x) &= x + 8 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x+8}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

	-3	-24	1	18
-8		24	0	-8
	-3	0	1	10

So,

$$\frac{f(x)}{g(x)} = -3x^2 + 1 + \frac{10}{x+8}$$

In other words, $h(x) = -3x^2 + 1$ and the remainder is $R = 10$.

5. Let polynomial $f(x)$ still be defined as $f(x) = -3x^3 - 24x^2 + x + 18$. Evaluate $f(-8)$.

You could do this the hard way.

$$\begin{aligned} f(-8) &= (-3)\cdot(-8)^3 \ + \ (-24)\cdot(-8)^2 \ + \ (1)\cdot(-8) \ + \ (18) \\ &= (-3)\cdot(-512) \ + \ (-24)\cdot(64) \ + \ (1)\cdot(-8) \ + \ (18) \\ &= (1536) \ + \ (-1536) \ + \ (-8) \ + \ (18) \\ &= 10 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(-8)$ equals the remainder when $f(x)$ is divided by $x+8$. Thus, $f(-8) = 10$.